

**Amendments to the Claims:**

Please amend the claims as indicated below, with insertions indicated by underlining and deletions by strike-through.

1-38. (canceled)

39. (previously presented) A method of culturing cells in a reaction system comprising a container for dialysis fluid, a culture vessel for culturing cells, and a membrane module, the membrane module comprising at least one tube-shaped dialysis membrane, the method comprising:

circulating a dialysis fluid through the container and the membrane module outside of the at least one tube-shaped dialysis membrane;

circulating a culture fluid containing cells through the culture vessel and inside the at least one tube-shaped dialysis membrane in the membrane module wherein the dialysis membrane separates the culture fluid from the dialysis fluid in the membrane module;

introducing a first gas into the culture fluid in the culture vessel; and

introducing a second gas into the culture fluid within the at least one tube-shaped dialysis membrane.

40. (previously presented) The method of claim 39, wherein the second gas is introduced into the culture fluid within the at least one tube-shaped dialysis membrane by one or more tubes connected to the inside of the at least one tube-shaped dialysis membrane.

41. (previously presented) The method of claim 39, wherein the second gas is introduced into the culture fluid within the at least one tube-shaped dialysis membrane by diffusion across the dialysis membrane from the dialysis fluid outside the tube-shaped dialysis membrane.

42. (previously presented) The method of claim 41, wherein the second gas is introduced into the dialysis fluid in the container for the dialysis fluid.

43. (previously presented) The method of claim 40, further comprising introducing the second gas into the culture fluid within the at least one tube-shaped dialysis membrane by

diffusion across the dialysis membrane from the dialysis fluid outside the tube-shaped dialysis membrane.

44. (previously presented) The method of claim 39, wherein the tube-shaped dialysis membrane has a diameter of 6 to 8 millimeters.

45. (previously presented) The method of claim 39, wherein the tube-shaped dialysis membrane has a diameter of 3 to 10 millimeters.

46-47. (canceled)

48. (previously presented) The method of claim 40, wherein the second gas is introduced into the culture fluid through a nozzle outlet attached to an end of the tube.

49. (previously presented) The method of claim 39, wherein the dialysis membrane comprises a material selected from the group consisting of regenerated cellulose, polyamide, polypropylene and polysulfone.

50-51. (canceled)

52. (previously presented) The method of claim 39, wherein the membrane is formed of Cuprophane.

53-54. (canceled)

55. (previously presented) The method of claim 39, wherein the membrane module has an area/surface ratio of at least about 5 m<sup>2</sup> per liter.

56. (previously presented) The method of claim 39, wherein the membrane module has an area/surface ratio of at least about 10 m<sup>2</sup> per liter.

57. (previously presented) The method of claim 39, wherein the membrane module has an area/surface ratio of at least about 13 m<sup>2</sup> per liter.

58. (previously presented) The method of claim 39, wherein the membrane module has an oxygen permeability coefficient equal to or greater than about 0.066 cm per minute.

59. (canceled)

60. (previously presented) The method of claim 39, further comprising increasing the pressure in at least one of the membrane module, the space for culturing the cells, and the container for dialysis fluid.

61. (previously presented) The method of claim 39, wherein the first gas is selected from the group consisting of air, oxygen, nitrogen, carbon dioxide and mixtures thereof.

62. (previously presented) The method of claim 39, wherein the second gas is selected from the group consisting of air, oxygen, nitrogen, carbon dioxide and mixtures thereof.

63. (previously presented) The method of claim 62, wherein the second gas is oxygen.

64. (previously presented) The method of claim 62, wherein the second gas is carbon dioxide.

65. (previously presented) The method of claim 39, wherein the cells are selected from the group consisting of microbial cells, fungal cells, animal cells, and plant cells.

66. (previously presented) The method of claim 65, wherein the cells are *Esherichia coli* cells.

67. (previously presented) The method of claim 39, further comprising sterilizing the reaction system.

68. (previously presented) The method of claim 67, further comprising inoculating the culture vessel with cells to be cultured subsequent to sterilizing the reaction system.

69. (previously presented) The method of claim 39, further comprising harvesting the cells.

70-80. (canceled)

81. (previously presented) A method for culturing cells in a reaction system comprising a container for dialysis fluid, a membrane module and a culture vessel for culturing cells, the module comprising at least two dialysis membranes with a first space in between the two membranes and a second space external to the two membranes as in FIG. 4;  
circulating a dialysis fluid through the second space of the membrane module;

circulating a culture fluid containing cells through the first space of the membrane module;

introducing a first gas into the culture fluid in the culture vessel; and

introducing a second gas into the culture fluid in the first space of the membrane module.

82. (previously presented) A reaction system for culturing cells, comprising:

a container for dialysis fluid;

a culture vessel for culturing cells; and

at least one membrane module inserted in between the container and the culture vessel, wherein the membrane module comprises at least two dialysis membranes with a first space for culture fluid in between the two membranes and a second space for dialysis fluid external to the two membranes as in FIG. 4, the membrane module further comprising a gas outlet to supply gas to culture fluid in the first space.

83. (canceled)

84. (previously presented) The reaction system of claim 82, wherein the container for dialysis fluid contains at least one gas-introducing device.

85. (previously presented) The reaction system of claim 82, wherein the membrane module further comprises a support located in the second space.

86-88. (canceled)

89. (previously presented) The reaction system of claim 82, wherein the membrane module has an area/surface ratio of at least about  $5 \text{ m}^2$  per liter.

90. (previously presented) The reaction system of claim 82, wherein the membrane module has an area/surface ratio of at least about  $10 \text{ m}^2$  per liter.

91. (previously presented) The reaction system of claim 82, wherein the membrane module has an area/surface ratio of at least about  $13 \text{ m}^2$  per liter.

92. (previously presented) The reaction system of claim 82, wherein the membrane module has an oxygen permeability coefficient equal to or greater than about  $0.066 \text{ cm per minute}$ .